

## **Appendix 5.3**

**FMP Details (Scope of Work, FMP Component Exhibits, Flood Risk  
Reduction Benefits, No Negative Impacts Assessment)**

Table 5.3.1: No Negative Impact Determination for Potentially Feasible FMPs

FMP ID	FMP Name	Hydraulic Model Type	No Negative Impact Requirements (100-yr Flood Event)*						FMP Meets ALL No Negative Impacts Requirements	No Negative Impacts based on Engineering Judgement**
			Increase in inundation in areas beyond the public right-of-way, project property, or easement	Increases in inundation of storm drains, channels, and roadways beyond design capacity	Max. Increase in 1D WSE < 0.05 ft	Max. Increase in 2D WSE < 0.35ft	Max. Increase in Peak Discharge < 0.5%			
033000007	Spring Meadows Estates Detention Pond Design	2D	✓ N	✓ N	N/A	✓ -3.80	✓ -8.4%	✓ Y	✓	
033000008	West Irving Creek Phases 2, 3, and 4	1D/2D	✓ N	✓ N	✗ 1.05	✗ 1.05	✗ 18.9%	✗ N	✓	
033000016	Arlington VC(A)-1 Drainage and Erosion Improvements	1D/2D	✓ N	✓ N	N/A	✗ 0.53	✗ 27.0%	✗ N	✓	
033000030	Lancaster/Foch Area Mitigation (Trail Drive)	2D	✓ N	✓ N	N/A	✓ 0.26	✗ 0.5%	✗ N	✓	
033000031	Linwood Park Flood Mitigation (University)	2D	✓ N	✓ N	N/A	✗ 3.34	N/A	✗ N	✓	
033000033	Sunnyvale Urban Flooding Reduction Improvements – Area 1	1D/2D	✓ N	✓ N	N/A	✓ 0.00	✗ 0.5%	✗ N	✓	
033000036	Sunnyvale Urban Flooding Reduction Improvements - Area 2	1D/2D	✓ N	✓ N	N/A	✓ 0.00	✗ 0.5%	✗ N	✓	

\*TWDB Technical Guidance - Exhibit C Section 3.6.A  
 \*\* Additional details regarding nature of impacts and reasoning for accepting impacts based on engineering judgment is included in individual project descriptions

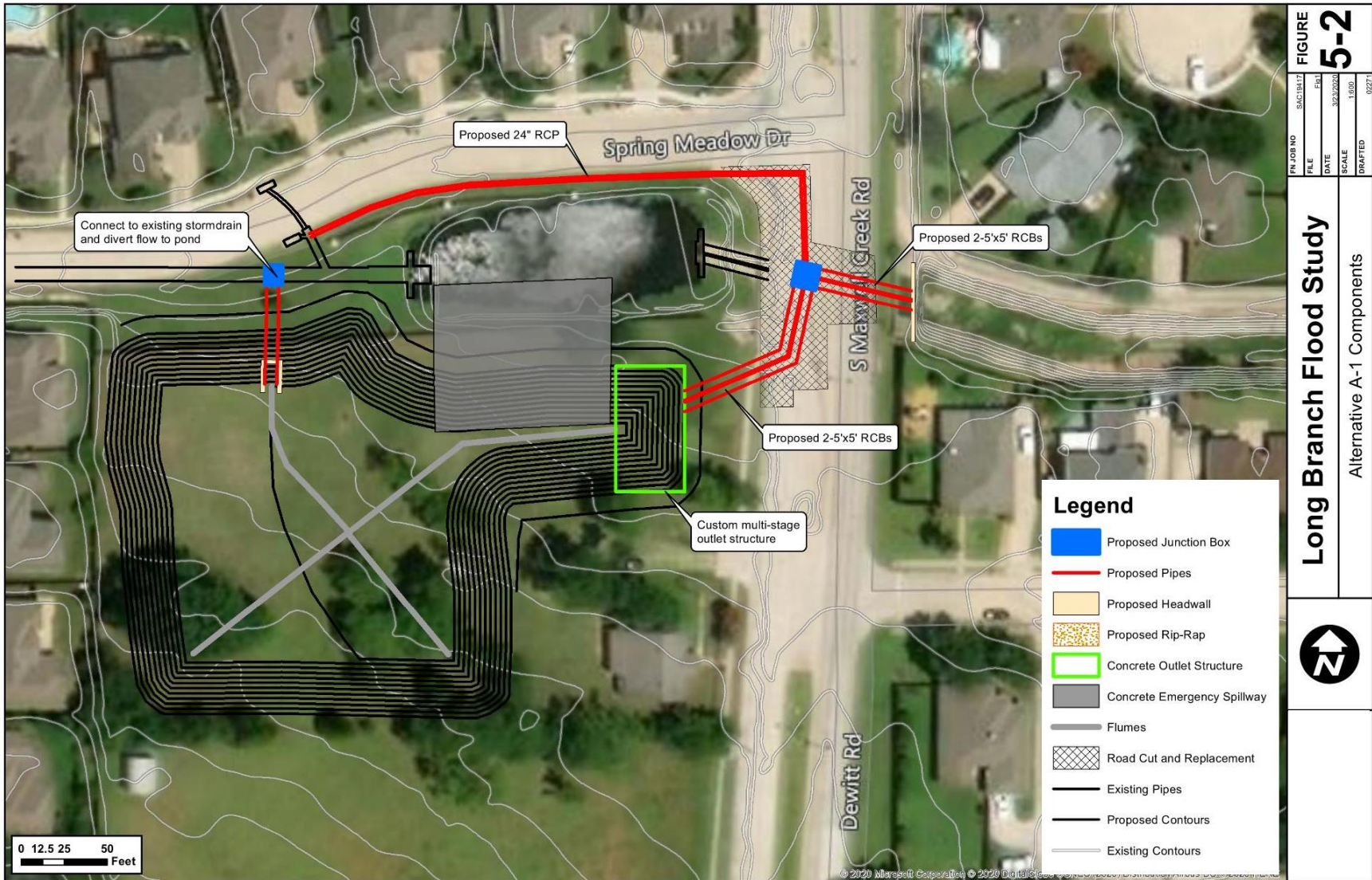
### Spring Meadows Estates Detention Pond Design (FMP 033000007)

The Spring Meadows Estates Detention Pond Design project was generated from the Long Branch Flood Study performed by Freese and Nichols, Inc. in 2020. The proposed project aims to mitigate flooding along the intersection of Spring Meadow Dr and Dewitt Rd in the City of Sachse. This area experiences frequent flooding and creates a considerable safety concern. The primary source of flooding for this area is the overflow from the existing Spring Meadows Estates retention pond. This pond was originally designed as a dry detention pond, but it is currently functioning as a wet pond which effectively eliminates its ability to store floodwaters.

A HEC-RAS 2D model was created for this study to evaluate existing and proposed conditions. The main component of this project is the design and construction of an off-line dry detention pond next to the existing pond that will provide a 100-year LOS (see **Figure 5.3.1**). A diversion structure would be required to redirect runoff from the existing storm drain system into the new pond. The new pond would be approximately 12 ft deep and would provide approximately 10 ac-ft of storage. Pond outlet works would be designed to control the 2-year and 100-year design storm events and would discharge to an existing concrete lined channel via 2-5'x5' RCBs. An additional 24-in RCP is required to reroute runoff from two inlets on Spring Meadows Dr and connect them to the proposed 2-5'x5' RCB's downstream. This project will require acquisition of a portion of the parcel south of the existing pond.

Following the implementation of the proposed improvements, an estimated 0.34 miles of roadway and 9 residential structures would be completely removed from the 100-year floodplain. This correlates to an estimated 18 individuals removed from the 100-year flood risk. Based on the comparative assessment performed for this FMP, this project meets all no negative impacts requirements (see **Table 5.3.1**).

Figure 5.3.1: Spring Meadows Estates Detention Pond Design - Project Components (FMP 033000007)



### West Irving Creek Phases 2, 3, and 4 (FMP 033000008)

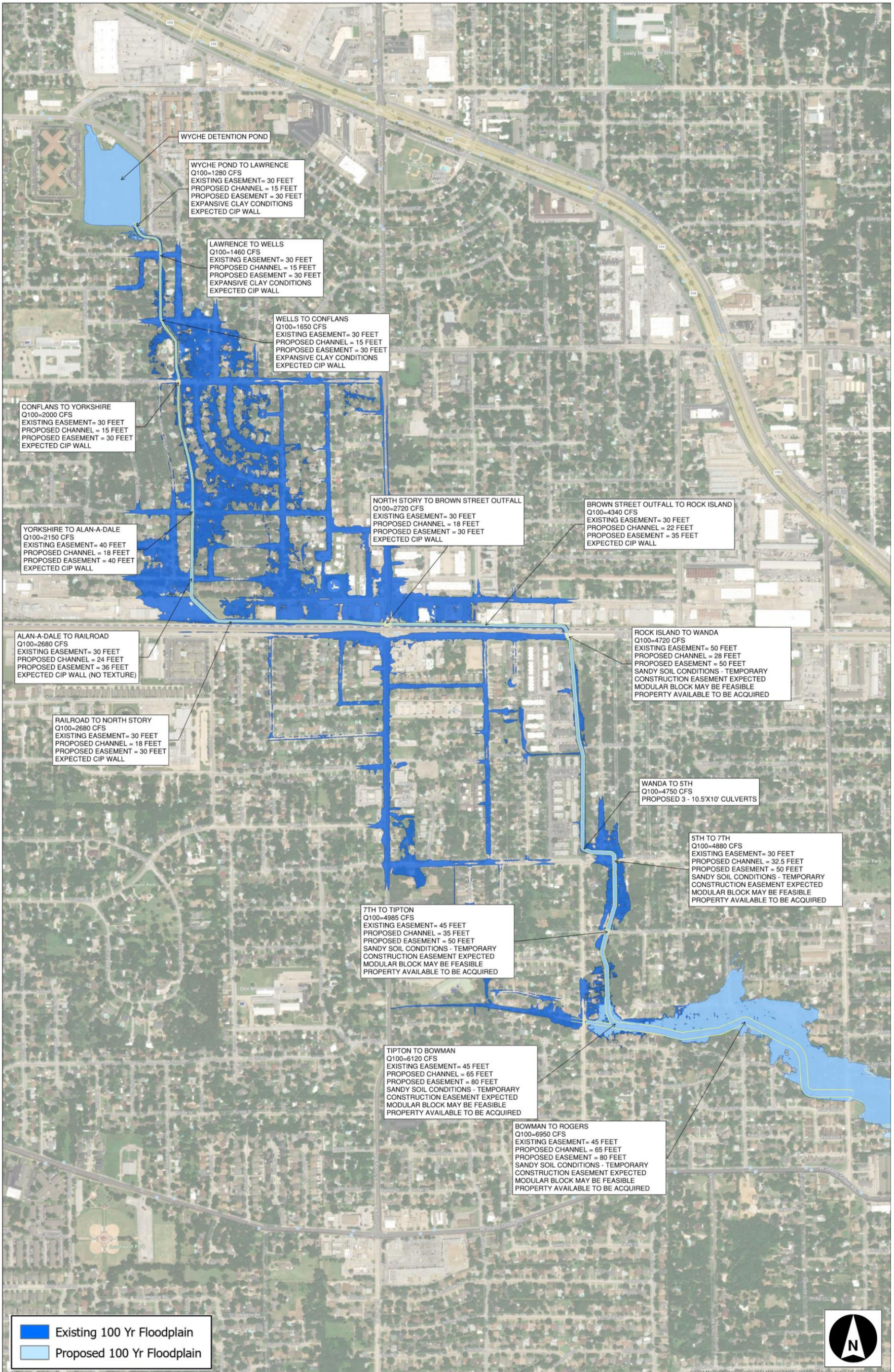
The West Irving Creek FMP was generated from the Flood Infrastructure Fund application #13792. The City of Irving experiences significant flooding within the West Irving Creek watershed, so this project identifies several elements to alleviate the flooding in the area.

A HEC-RAS 1D/2D model was created to analyze existing flooding conditions, develop flood mitigation alternatives, and evaluate the impacts of the proposed improvements. The West Irving Creek channel improvements project consists of reconstruction of over 2.5 miles of shallow trapezoidal concrete channel as deeper vertical walled channel to increase capacity and relieve historical flooding issues (see **Figure 5.3.2**). The vertical walled channels allow the project to remain within a similar footprint as the existing channel to minimize easement needs and impacts to private properties while meeting the flood carrying capacity goals of the project. The channel improvements will also require the reconstruction of 15 road crossings and several miles of wastewater main. In conjunction with the channel improvements, upstream detention improvements will be made as well as the implementation of water quality ponds to reduce pollutant load in the channel and to provide amenity to the adjoining neighborhoods. These improvements will mitigate flood events associated with the 1% annual chance flood (100-year LOS).

The estimated flood risk reduction benefits following the implementation of West Irving Creek FMP include the removal of an estimated 5 miles of roadway and 240 structures from the 100-year floodplain, 217 of which are residential structures. This correlates to an estimated 1,073 individuals removed from the 100-year flood risk. Additionally, 6 structures would have reduced area within the 100-year floodplain but would not be fully removed from flood risk following these improvements.

Based on the comparative assessment performed for this FMP, this project does not meet two of the no negative impacts requirements (see **Table 5.3.1**). Increases in peak discharge are expected at the downstream areas of the improved channel due to the significant increase in channel capacity. However, these increases are fully contained within the proposed channel and do not cause any adverse impact to adjacent properties. There is one area within the project's zone of influence that would experience an increase of approximately 1 foot in water surface elevation, but this is a public park area with no insurable structures. Furthermore, mitigation options (grading) have been considered for this area as part of the current analysis of the project and it is expected that they can offset this increase in water surface elevations. Based on these factors, the RFPG considers that the West Irving Creek FMP conforms to the no negative impacts requirements.

Figure 5.3.2: West Irving Creek Phases 2, 3, and 4 - Project Components (FMP 033000008)



### **Arlington VC(A)-1 (FMP 033000016)**

The Arlington VC(A)-1 FMP, developed from the unfunded Flood Infrastructure Fund application #13646, proposes options for drainage and erosion improvements. The proposed project includes improvements to four low-capacity crossings at Woodland Drive, Sylvan Drive, Park Hill Drive, and West Lamar Boulevard (see **Figure 5.3.3**). HEC-HMS and HEC-RAS models were created to analyze the impact that the proposed improvements would have based on ultimate land use conditions. A stream assessment was also performed and identified erosion risk alternatives to improve the stability of the stream bed and banks.

The proposed project will provide a minimum of a 25-year LOS (4% annual chance flood event). The LOS for the four crossings mentioned above range from 25-year to 100-year. However, flood risk reduction benefits are expected for all crossings up to the 100-year event.

Following the implementation of these drainage and erosion improvements, an estimated 0.86 mile of roadway and 72 structures would be removed from the 100-year floodplain, 65 of which are residential structures. This correlates to an estimated 290 individuals removed from the 100-year flood risk. Additionally, 21 structures would have reduced area within the 100-year floodplain but would not be fully removed from flood risk following these improvements.

Based on the comparative assessment performed for this FMP, the project does not meet all no negative impacts requirements (see **Table 5.3.1**). Water surface elevation increases up to 0.53 feet are calculated downstream of the proposed improvements. The increases do not impact insurable structures in the watershed. Therefore, the RFPG considers that this FMP meets the no negative impact requirements.

Figure 5.3.3: Arlington VC(A)-1 – Project Components (FMP 03300016)



Stream VC(A)-1 Watershed Study  
Alternatives Workmap



### Lancaster/Foch Area Mitigation (FMP 033000030)

The Lancaster/Foch Area Mitigation FMP is sponsored by the City of Fort Worth. Alternatives<sup>1</sup> were evaluated to provide storm drain relief along Norwood Street between West 7<sup>th</sup> Street and Lancaster Avenue, at the Lancaster Avenue/Bledsoe Street intersection, and the Lancaster Avenue/Currie Street intersection.

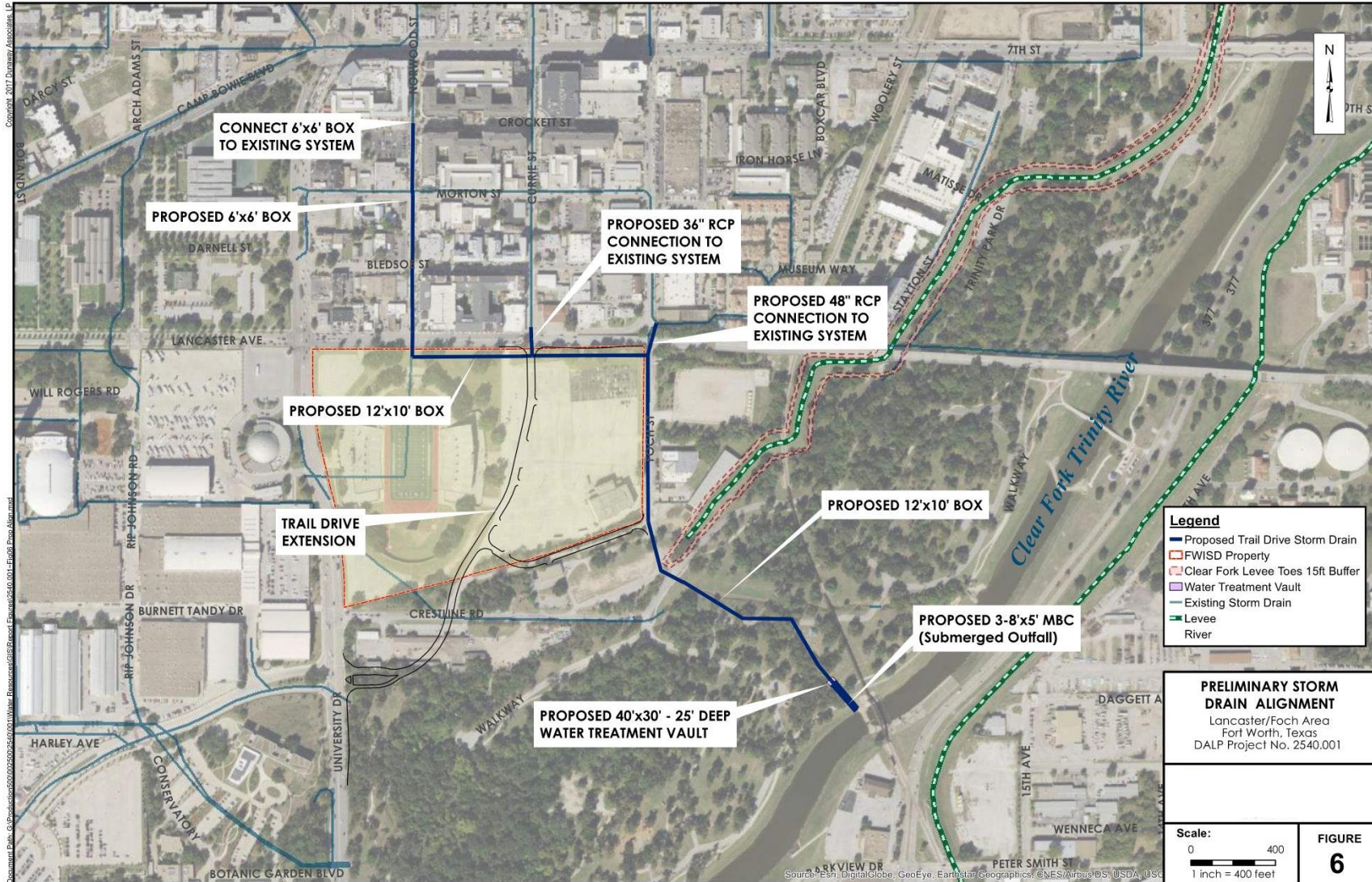
A 2D ICM model was developed to analyze the storm drain trunk lines and identify the deficiencies in the system. The proposed project includes a 6'x6' box section along Norwood Street north of Lancaster Avenue and a 12'x10' box section along the remainder of the relief system length to convey the 100-year discharge (see **Figure 5.3.4**).

Following the implementation of these mitigation measures, an estimated 0.74 mile of roadway and 19 structures would be removed from the 100-year floodplain, 2 of which are residential structures. This correlates to an estimated 808 individuals removed from the 100-year flood risk. Additionally, 15 structures would have reduced area within the 100-year floodplain but would not be fully removed from flood risk following these improvements. Based on the comparative assessment performed for this FMP, the project does not meet all no negative impacts requirements (see **Table 5.3.1**). There appears to be an increase in peak discharge. The increase occurs in an area west of the proposed improvements; therefore, it is not considered to be a result of the proposed improvements.

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<sup>1</sup> Lancaster/Foch Area Flood Mitigation Study, Dunaway, August 2017.

Figure 5.3.4: Lancaster/Foch Area Mitigation - Project Components (FMP 033000030)



### Linwood Park Flood Mitigation (FMP 033000031)

The City of Fort Worth completed a flood mitigation study for the Linwood Park area in 2017<sup>2</sup>. This study identified approximately 2,000 cfs of stormwater is generated by the area west of University Drive. Therefore, storm drain improvements west of University Drive are necessary to reduce the amount of runoff that reaches the Linwood Park area. Alternatives were identified to reduce the potential for inundation during the 100-year storm event.

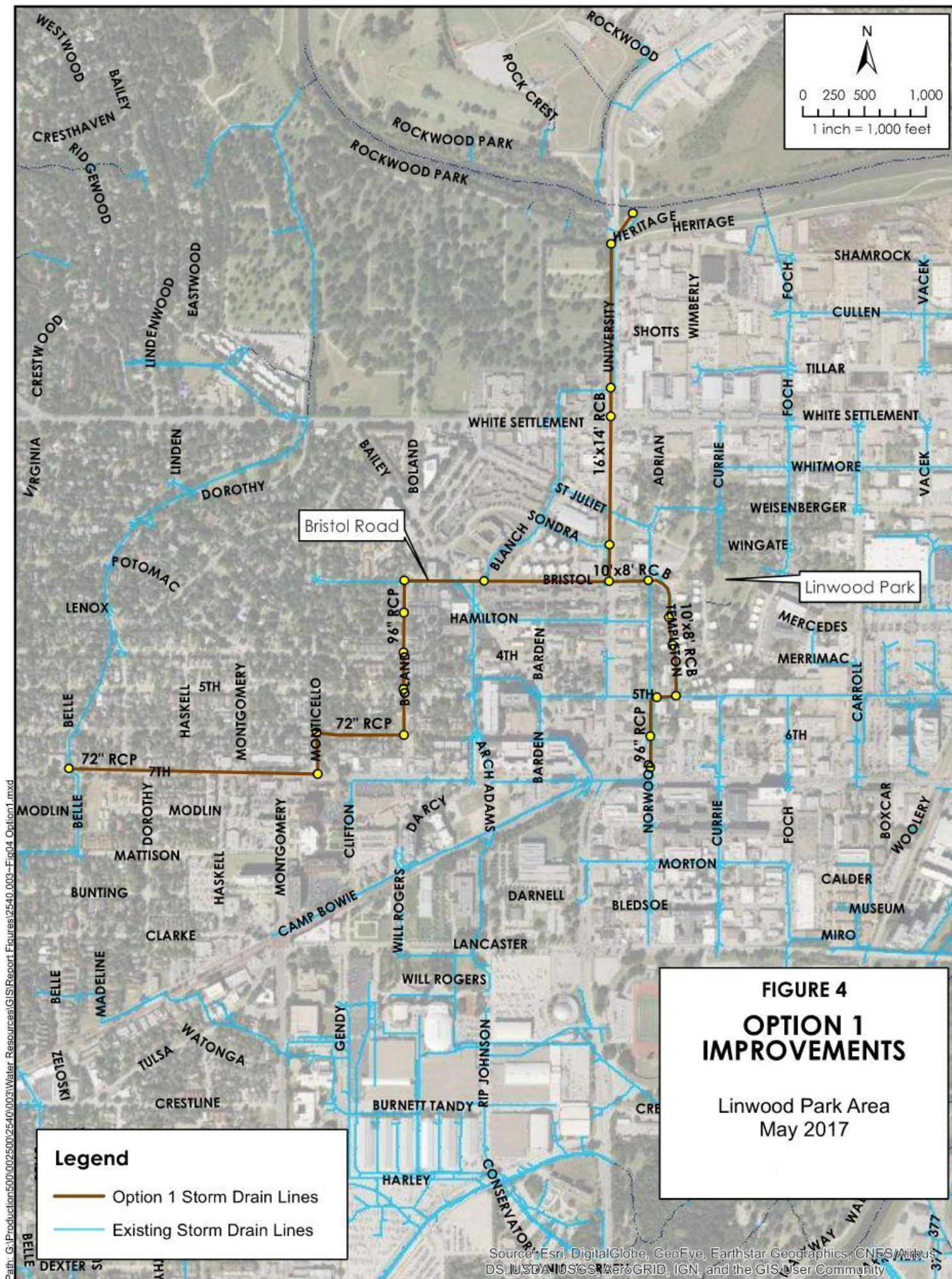
An ICM model was created to evaluate the existing storm drain network and potential mitigation alternatives for multiple storm events. One branch of the proposed storm drain system would begin at Belle Place and run along West 7<sup>th</sup> Street, following three residential streets before turning east on Bristol Road and intersecting the line on University Drive. The storm drain would then run along University Drive to the West Fork Trinity River. A second feeder system would extend east from University Drive along Bristol Road, then turn south on Templeton Drive and extend south along Norwood Street to just north of West 7<sup>th</sup> Street (see **Figure 5.3.5**).

Following the implementation of these improvements, an estimated 0.14 miles of roadway and 6 structures would be removed from the 100-year floodplain, 3 of which are residential structures. Additionally, 72 structures would have reduced area within the 100-year floodplain but would not be fully removed from flood risk following these improvements. This correlates to an estimated 1,026 individuals removed from the 100-year flood risk. Based on the comparative assessment performed for this FMP, the project does not meet all no negative impacts requirements (see **Table 5.3.1**). There is an increase in the water surface depth in the 2D ICM model. The increases occur in the locations of the proposed pipes; therefore, it is an acceptable increase.

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<sup>2</sup> Linwood Park Flood Mitigation Study, Dunaway, August 2017.

Figure 5.3.5: Linwood Park Flood Mitigation - Project Components (FMP 033000031)



### Sunnyvale Urban Flooding Reduction Improvements – Area 1 (FMP 033000033)

The City of Sunnyvale completed a stormwater masterplan for the Long Creek watershed in 2018<sup>3</sup>. This study identified alternatives for local area improvements to reduce the potential for inundation during the ultimate conditions 100-year storm event. This FMP pertains to Area 1, which includes the Sunnyvale Middle and High School, portions of the Deer Creek neighborhood, and the ditch and culvert system along Tripp Road from Collins Street to East Fork Road. The ditch and culvert system along Tripp Road is undersized for the 100-year event, causing potential flooding to the road and neighboring structures. Causes for flooding along Tripp Road include not only the size of the culverts and ditches, but also the grades. Some of the systems have negative slopes or are filled with sediment. Portions of Tripp Road experience significant flooding, with upwards of 3 feet of inundation at the cross culvert from the Deer Creek detention pond.

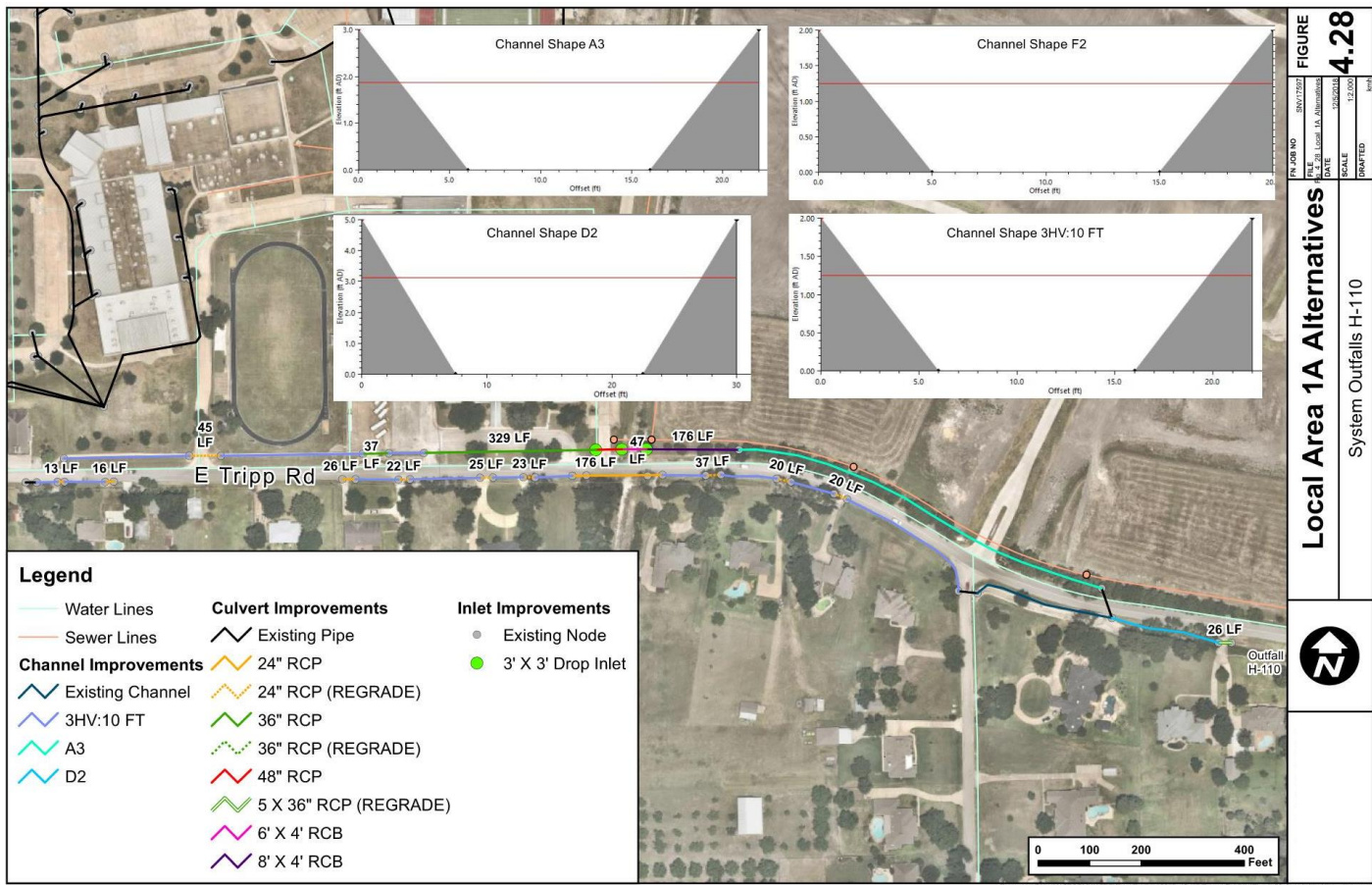
An ICM model was created to model the performance of existing stormwater infrastructure, identify areas of inundation, and develop alternatives to mitigate flooding risks. The proposed improvements for Area 1 include an alternative ditch and culvert system for Tripp Road, which was sized to contain the 100-year ultimate flows within the right-of-way and under the driveways. Proposed improvements also include increasing existing ditch, culvert, and pipe sizes, adjusting inlet sizes and parameters for inlets receiving runoff from the school, and adjusting flowlines to establish a positive slope for the system. Channel geometry was selected to fit within the estimated right-of-way. Where capacity issues necessitated culvert sizes larger than 24-in, a multiple-barrel culvert or wider box culvert was proposed to avoid constructability issues related to the residential driveways (see **Figure 5.3.6**).

Following the implementation of these local area improvements, an estimated 0.32 mile of roadway and 14 structures would be removed from the 100-year floodplain, which is a residential structure. This correlates to an estimated 844 individuals removed from the 100-year flood risk. Based on the comparative assessment performed for this FMP, the project meets all no negative impacts requirements (see **Table 5.3.1**).

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<sup>3</sup> Town of Sunnyvale Stormwater Masterplan, Freese and Nichols, Inc., November 2018.

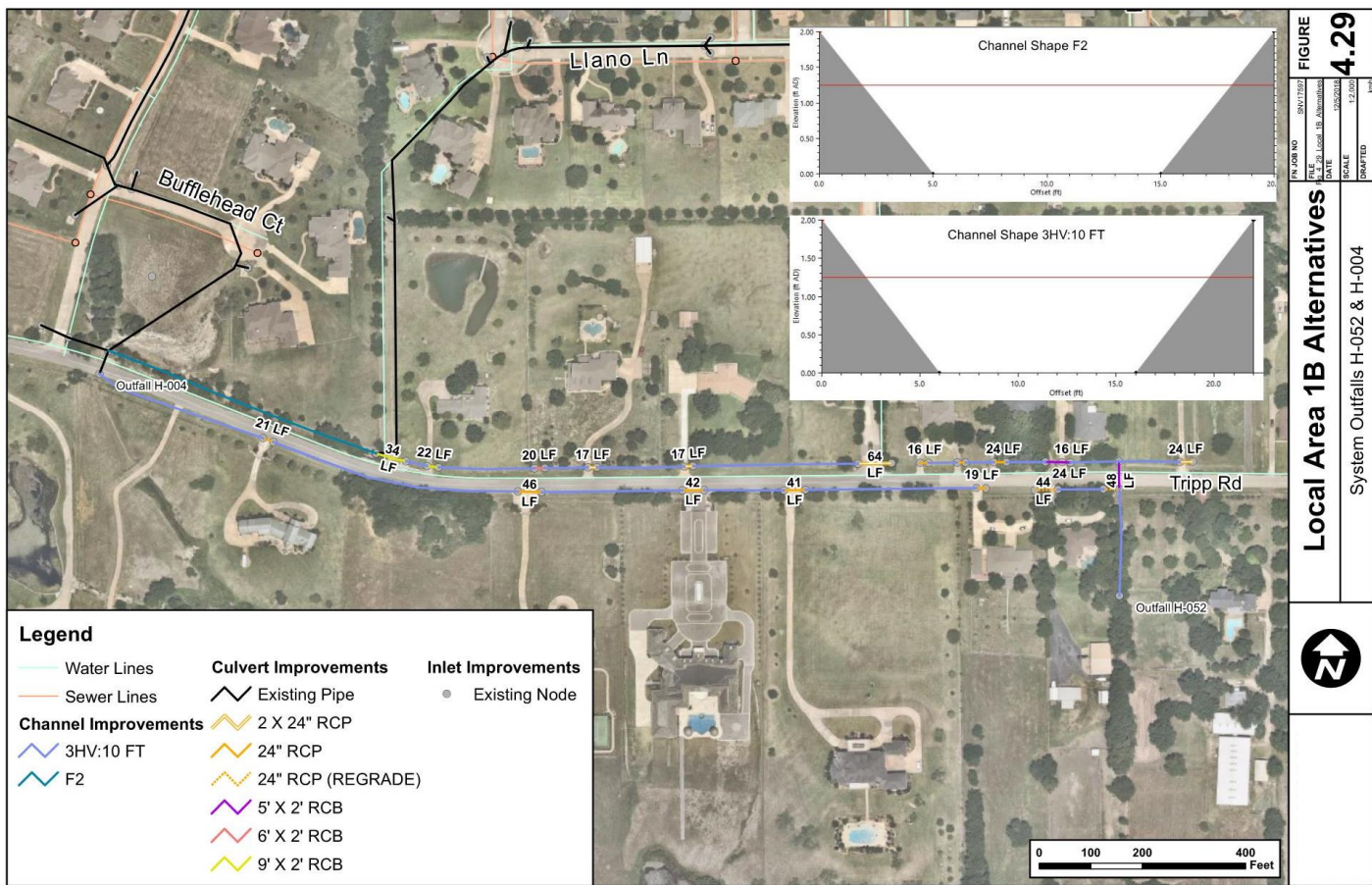
Figure 5.3.6: Urban Flooding Reduction Improvements – Area 1– Project Components (FMP 033000033)



**FIGURE 4.28**

**Local Area 1A Alternatives**

System Outfalls H-110



**FIGURE 4.29**

**Local Area 1B Alternatives**

System Outfalls H-052 & H-004



**FIGURE 4.30**

**Local Area 1C Alternatives**

System Outfalls H-119 and H-130

### Sunnyvale Urban Flooding Reduction Improvements – Area 2 (FMP 033000036)

The City of Sunnyvale completed a stormwater masterplan for the Long Creek watershed in 2018<sup>4</sup>. This study identified alternatives for local area improvements to reduce the potential for inundation during the ultimate conditions 100-year storm event. This FMP pertains to Area 2, which includes storm drainage infrastructure along Tripp Road and Jobson Road adjacent to and including Sunnyvale Estates neighborhood. The ditch and culvert system along Tripp Road is undersized for the 100-year event, causing structure inundation and road overtopping. Causes for flooding along Tripp Road include not only the size of the culverts and ditches, but also the grades. Some of the systems have negative slopes or have very flat slopes which greatly reduce the channel capacity.

An ICM model was created to model the performance of exiting stormwater infrastructure, identify areas of inundation, and develop alternatives to mitigate flooding risks. Proposed improvements include increasing existing ditch, culvert, and pipe sizes, and adjusting flowlines to establish a positive slope for the system. Channel geometry was selected to fit within the estimated right-of-way. An additional parallel 60" RCP and an additional 42" RCP are proposed for the two existing culvert crossings at Jobson Road to reduce inundation depths at Jobson Road (see **Figure 5.3.7**).

Following the implementation of these local area improvements, an estimated 0.8 mile of roadway and 32 structures would be removed from the 100-year floodplain, of which 32 are residential structures. This correlates to an estimated 113 individuals removed from the 100-year flood risk. Based on the comparative assessment performed for this FMP, the project does not meet all no negative impacts requirements (see **Table 5.3.1**). There appears to be an increase in peak discharge; however, this increase is considered to be acceptable based on the engineering judgement of the Technical Consultant.

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<sup>4</sup> Town of Sunnyvale Stormwater Masterplan, Freese and Nichols, Inc., November 2018.

Figure 5.3.7: Urban Flooding Reduction Improvements – Area 2– Project Components (FMP 033000036)

